Following questions are based on assertion and reasoning. Two statements are made here as statement 1 and statement 2. In each of the following question, read the two statements and choose the most appropriate answer from the options given below:

Q1. Statement 1 :A body can have acceleration even it its velocity is zero at a given instant of time .
Because
Statement 2 : A body is momentarily at rest when it reverses its direction of motion.

(1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
(2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
(3) Statement 1 is correct but statement 2 is false
(4) Statement 1 is false but statement 2 is correct.

Q2. Statement 1: a coin is placed on phonogram turn table. The motor is started, coin moves along the moving table.
Because
Statement 2 : the rotating table is providing necessary centripetal force to the coin .

(1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
(2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
(3) Statement 1 is correct but statement 2 is false
(4) Statement 1 is false but statement 2 is correct.

Q3. Statement 1 : banking of road reduces the wear and tear of tyres of vehicles taking turn on curved roads.
Because
Statement 2 : component of normal reaction of ground provides necessary centripetal force on the tyres passing over a banked curved road which is otherwise to be provided by frictional force.

(1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
(2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
(3) Statement 1 is correct but statement 2 is false
(4) Statement 1 is false but statement 2 is correct.

Q4. Statement 1 : the work done in bringing a body down from the top to the base along a frictionless incline plane is the same as the work done in bringing it down from the vertical side .
Because
Statement 2 : the gravitational force on the body along the inclined plane is the same as that along the vertical side.

(1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
(2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
(3) Statement 1 is correct but statement 2 is false
(4) Statement 1 is false but statement 2 is correct.

Q5. Statement 1 : if in a collision , the first body gets embedded into the second body and the two move together with same velocity , then there is no loss of kinetic energy .
Because
Statement 2 : in a perfectly inelastic collision , momentum is not conserved ; only the kinetic energy is conserved.

(1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
(2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
(3) Statement 1 is correct but statement 2 is false
(4) Both statement 1 and 2 are false .

Question (Q6-Q8) are based on short paragraph. Read the paragraph carefully and answer the questions that follow.
Paragraph : a particle starts from rest with a time varying acceleration a =( 2t -4 ). Here t is in seconds and a in $m/s^2$.
Q6. Particle comes to rest after a time t = ..... second .

(1) 1
(2) 4

(3) 3

(4) 2

Q7. Maximum velocity of particle in negative direction is at t = .... second .

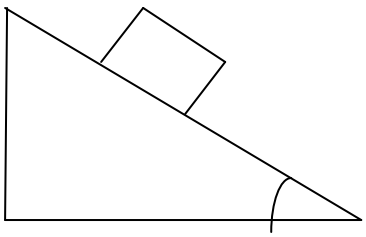
(1) 3
(2) 4
(3) 2
(4) 1

Q8. The velocity time graph of the particle is .....

(1) Parabola passing through origin
(2) Straight line not passing through origin
(3) Parabola not passing through origin
(4) Straight line passing through origin.

Question (Q9-Q10) are based on short paragraph. Read the paragraph carefully and answer the questions that follow.

A block of mass m is placed over a wedge inclined at $30^0$ to the horizontal. Coefficient of friction $\mu$ is just half the minimum value required to keep it stationary in position.



Q9. Block can be kept at rest even with this value of $\mu$ with respect to wedge if the wedge is moved with an acceleration a towards :

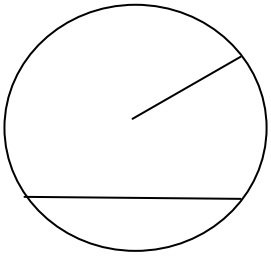
(1) Right
(2) Left
(3) Vertically upwards
(4) Vertically downwards

Q10. What is the minimum value of acceleration of wedge to keep the block stationary with respect to the wedge in either of the four cases.

(1) $\frac{g}{2\sqrt{3}}$
(2) $\frac{\sqrt{3}g}{4}$
(3) $\frac{\sqrt{3}g}{7}$
(4) $\frac{g}{2\sqrt{5}}$

Question (Q11-Q12) are based on short paragraph. Read the paragraph carefully and answer the questions that follow.

Paragraph : a rod of length l (<2R) is kept inside a smooth spherical shell of radius R as shown below in figure. Mass of the rod is m.



Q11. Keeping mass to be constant if length of the rod is increased (but always less than the diameter of the shell) the normal reactions at two ends of the rod :

(1) Will remain constant
(2) Will increase
(3) Will decrease
(4) May increase or decrease

Q12. The normal reaction when l = R is :

(1) $\frac{mg}{2}$
(2) $\frac{mg}{4}$
(3) $\frac{mg}{2\sqrt{3}}$
(4) $\frac{mg}{\sqrt{3}}$

Q13. what is the percentage error in the measurement of time period of a pendulum is maximum error in the measurement of **L** and **g** are **2%** and **4%** respectively?

**(1)** 6%
**(2)** 4%
**(3)** 3%
**(4)** 5%

Q14. The distance x traversed in time t is represented by the equation $t = ax^2 + bx$ , where a and b are constants. The acceleration is

(1) $-2av^3$
(2) $2av^2$
(3) $-2av^2$
(4) $2bv^3$

Q15. During paddling of a bicycle ,the force of friction exerted by the ground on the two wheels is such that it acts :

(1) In the backward direction on the front wheel and in the forward Direction on the rear wheel
(2) In the forward direction on the front wheel and in the backward direction on the rear wheel
(3) In the backward direction on both the front and the rear wheels
(4) In the forward direction on both the front and the rear wheels.

Q16. A solid sphere is rotating in a free space. If the radius of the sphere is increased keeping mass same, which one of the following will not be affected ?

(1) Moment of inertia
(2) Angular momentum
(3) Angular velocity
(4) Rotational kinetic energy

Q17. A particle of mass 2 kg located at the position (**i+j**)m has a velocity 2 (**i-j+k**) m/s . its angular momentum about z- axis in kg $-m^2/s$ is:

(1) Zero
(2) +8
(3) 12
(4). -8

Q18. The gravitational field due to a mass distribution is **E =** $\frac{A}{x^2}$ ,in **x** direction . Here **A** is a constant. Taking the gravitational potential at infinity to be zero ,potential at x is :

(1) $\frac{2A}{x}$

(2) $\frac{2A}{x^3}$

(3) $\frac{A}{x}$

(4) $\frac{A}{2x^2}$

Q19. A planet is revolving round the sun in an elliptical orbit. The work done on the planet by the gravitational force of sun is zero: consider the following four statements.

(a) In some parts of the orbit.
(b) In any part of the orbit.
(c) In no part of the orbit.
(d) In one complete revolution.

(1) (a) ,(d)
(2) (c) ,(a)
(3) (b),(d)
(4) (a) , (c)

Q20. A ball of mass M is suspended from a wire of length L ,area of cross-section A and Young's modulus is Y. The elastic potential energy stored in the wire is :

(1) $\frac{M^2g^2L}{2AY}$

(2) $\frac{Mg}{2AYL}$

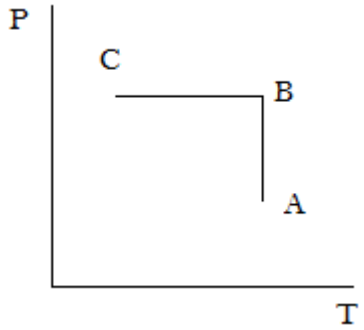
(3) $\frac{M^2g^2A}{2YL}$

(4) $\frac{MgY}{2AL}$

Q21. A source of frequency **10Hz** when vibrated over the mouth of a closed organ pipe is in unison at **300K** . the beats produced when temperature rises by **1 K** is :

**(1)** 30 Hz
**(2)** 13.33 Hz
**(3)** 16.67 Hz
**(4)** 40 Hz

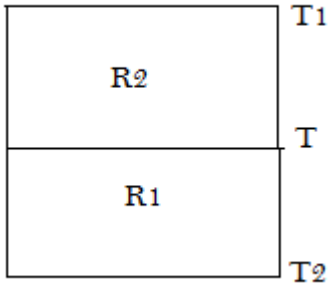
Q22. Ideal gas is taken through a process from the state A to B to C and is represented in the P-T diagram ,as shown below :




Consider the following statements related to the above process

(1) In the process AB, work done by system is positive
(2) In process AB,heat is rejected
(3) In process AB, internal energy increases
(4) In process AB internal energy decreases and in process BC, internal energy increases.

Q23. . Consider the two insulating sheets with thermal resistance $R_1$ and $R_2$ as shown in the figure. The temperature at the interface $\theta$ is :




(1) $\frac{T_1T_2R_1R_2}{(T_1+T_2)(R_1+R_2)}$

(2) $\frac{T_1R_2+T_2R_1}{R_1+R_2}$

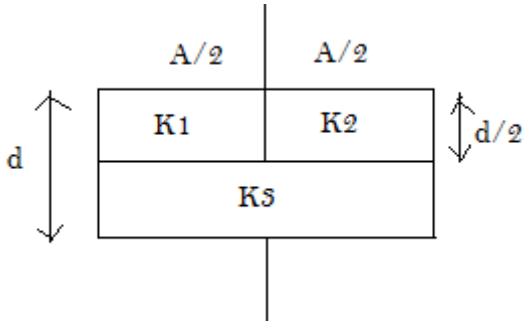
(3) $\frac{T_1R_1+T_2R_2}{R_1+R_2}$

(4) $\frac{(T_1+T_2)R_1R_2}{R_1^2+R_2^2}$

Q24. The ratio of the speed of the sound in nitrogen gas to that in helium gas , at 300K is

(1) $\sqrt{\frac{2}{7}}$
(2) $\sqrt{\frac{1}{7}}$
(3) $\frac{\sqrt{3}}{5}$
(4) $\frac{\sqrt{6}}{5}$

Q25. A parallel plate capacitor of area A ,plate separation d and capacitance C is filled with three different dielectric materials having dielectrics constants $K_1$ , $K_2$ and $K_3$ as shown. If a single dielectric material is to be used to have the same capacitance C in this capacitor then its dielectric constant K is given by :




(1) $\frac{1}{K}=\frac{1}{K_1}+\frac{1}{K_2}+\frac{1}{2K_3}$

(2) $\frac{1}{K}=\frac{1}{K_1+K_2}+\frac{1}{2K_3}$

(3). $\frac{1}{K} = \frac{K_1K_2}{K_1+K_2} + 2K_3$

(4). K= $\frac{K_1K_3}{K_3+K_1} + \frac{K_2K_3}{K_2+K_3}$

Q26. A wire of length l is bent in the form of a circular coil of some turns. A current i flows through the coil . the coil placed in a uniform magnetic field B. The maximum torque on the coil can be :

(1) $iBl^2/4\pi$
(2) $iBl^2/\pi$
(3) $iBl^2/2\pi$
(4) $2iBl^2/\pi$

Q27. A voltamete has a resistance of G ohm and range V volt. The value of resistance used in series to convert it into a voltameter of range nV volts is :

(1) nG
(2) (n-1)G
(3) G/n
(4) G/(n-1)

Q28. An alternating voltage ,of angular frequency $\omega$ is induced in electric circuit consisting of an inductance L and capacitance C ,connected in parallel. Then across the inductance coil :

(1) Current is maximum when $\omega^2 = \frac{1}{LC}$
(2) Current is minimum when $\omega^2 = \frac{1}{LC}$
(3) Voltage is minimum when $\omega^2 = \frac{1}{LC}$
(4) Voltage is maximum when $\omega^2 = \frac{1}{LC}$

Q29. When two inductors each of inductance L are connected in parallel and are quite far from each other,the equivalent inductance is :

(1) L/4
(2) L/2
(3) L
(4) 2L

Q30. A coil of resistance R and inductance L is connected to a battery of emf E volts. The final current in the coil is :

(1) E/R
(2) E/L
(3) $\sqrt{E}/\sqrt{(R^2+L^2)})$
(4) $\sqrt{EL}/\sqrt{(R^2+L^2)}$

Q31. When the object is at a distance x and y from a lens, a real image and a virtual image is formed respectively of same magnification. The focal length of the lens is :

**(1)** $(x+y)/2$
**(2)** $x-y$
**(3)** $\sqrt{xy}$
**(4)** $x+y$

Q32. Let $I_0$ be the intensity of the principle maximum in he single slit diffraction patterns, then what will be the intensity when the slit width is doubled ?

(1) $4I_0$
(2) $2I_0$
(3) $I_0/2$
(4) $I_0$

Q33. The dominant mechanisms for motio nof charge carriers in forward and reverse biased silicon p-n junctions are :

(1) Drift in forward bias, diffusion in reverse bias
(2) Diffusion in forward bias ,drift in reverse bias
(3) Diffusion in both forward and backward bias
(4) Drift in both forward and backward bias.

Q34. In a p-n junction diode not connected to any circuit

(1) The potential is the same everwhere
(2) The p type side is at a higher potential than the n type side
(3) There is an electric field at the junction directed from the n side to the p type.
(4) There is an electric field at the junction directed from the p-type side to the n-type side.

Q35. The half life period of a radioactive element x is same as the mean life time of another radioactive element y. Initially both of them have same number of atoms. Then :

(1) X and Y have the same decay rate initially
(2) X and Y decay at the same rate always
(3) Y will decay at a faster rate than X
(4) X will decay at faster rate than Y.

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